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August 12, 1996

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FEDERAL COMMUNICATIONS COMMISSION
OFFICE OF SECRETARY

Mr. William F. Caton
Acting Secretary
Federal Communications Commission
1919 M Street, NW, Room 222
Washington, DC 20554

Dear Mr. Caton:

Re: CC Docket No. 96-45, *Federal-State Joint Board on Universal Service*

On behalf of Pacific Telesis Group, please find enclosed an original and six copies of its "Erratum to Further Comments on Cost Proxy Model" in the above proceeding. In our August 9 filing of this docket, there were errors and omitted pages in Appendix A, Declaration of Richard Emmerson. Please substitute the attached corrected Declaration for Appendix A in our August 9 filing.

Please stamp and return the provided copy to confirm your receipt. Please contact me should you have any questions or require additional information concerning this matter.

Sincerely,



Enclosure

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Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington, D.C. 20554

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AUG 12 1996

FEDERAL COMMUNICATIONS COMMISSION
OFFICE OF SECRETARY

In the Matter of

Federal-State Joint Board on Universal Service

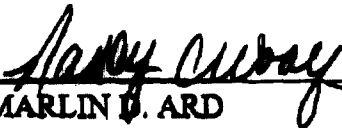
CC Docket No. 96-45

**ERRATUM TO FURTHER COMMENTS OF PACIFIC TELESIS GROUP
ON COST PROXY MODEL**

Pacific Telesis Group files this Erratum to its Further Comments on Cost Proxy Models. In Appendix A, Declaration of Richard D. Emmerson, filed on Friday August 9, 1996 certain pages contained incomplete information. For ease of use, we hereby submit a corrected copy of Appendix A in its entirety.

Respectfully submitted,

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Date: August 12, 1996

APPENDIX A

DECLARATION OF DR. RICHARD D. EMMERSON

My name is Richard D. Emmerson, Ph.D. and I declare as follows.

I am the President and CEO of INDETEC International, Inc. I am filing this affidavit on behalf of Pacific Bell (the "Company"). My business address is 341 La Amatista, Del Mar, CA 92014. I have a Ph.D. in economics from the University of California at Santa Barbara. During the past 20 years, I have taught in the Department of Economics at the University of California, San Diego, and I have consulted, testified, and taught courses on economic issues in telecommunications. Much of my consulting and teaching is about incremental cost study methodologies. My staff and I have conducted over one hundred projects involving incremental costs in telecommunications.

I am submitting this affidavit in response to the Commission's request for further comments on cost models.

I. Key Characteristics To Be Considered In The Development Of Cost Proxy Models For Determining Universal Service Subsidy Levels.

A. Development of Base Geographic Information

The primary driver of loop investment is distance and a secondary driver is density as determined by the geographic clustering of end users. Since both of these are related to the location of customers within a specific area, the method chosen for representing information on a geographic basis is a crucial determinant of the reliability of the answers generated; the more accurate are the represented customer locations, the more realistic will be the model results. The ideal unit of geography is either individual customers¹ or a small, uniform size area that captures the dispersion of population,

¹ None of the models reviewed and evaluated here uses the location of individual customers; only the cost proxy model is capable of doing so (an early version of the Cost Proxy Model was implemented in

reflects differences in terrain, is directly comparable across the nation and closely approximates the service areas that engineers consider when making decisions on facility provisioning.

B. Determination of Technology and Facility Mixes

Technology choices and facility mix determinations also have a significant impact on the investment required levels for providing customer access. The impact of these choices is reflected in the selection of the breakover point for use of electronic facility provisioning and in the placement costs which the company incurred (e.g. burying cable in some densely populated areas may be considerably more costly than placing aerial facilities. The ideal determinant is a methodology which reflects the actual choices faced by engineers in placing facilities. Included in this consideration would be a combination of density, soil type and community regulations.

C. Methodology Used in Assigning Locations to Wire Centers

The wire center assignment methodology has a twofold impact on the determination of loop investment. First, identification of a particular wire center to serve a household or clustered group of households has a direct bearing on the length of the loop required, the difficulty of placement in the terrain, and other cost related characteristics. Second, the identification of serving wire center determines the local exchange company that serves a geographic area. In the first case the cost of the loops represented in the model will differ from the serving company's attainable cost if end users are assigned to the wrong wire center. In the second case, inaccurate assignment can lead to shifts in subsidy requirements between companies; clearly an undesirable effect. Once again, the ideal methodology should reflect the real world decisions which would result from efficient engineering practices. It should take into account such things

California using actual customer locations – later versions used small uniform geographic groups of customers in order to avoid the need to use proprietary data).

as impassable terrain, communities of interest and population clusters in the same manner as these characteristics are considered by engineers and construction planners.

D. Assumptions Behind the Development of Financial Data

Financial inputs have a significant impact on universal service costs. These inputs include determination of economic lives of equipment, and the associated depreciation levels. They include selection of the cost of money, determination of reasonable contribution levels to shared and common costs, and selection of the appropriate levels of element costs and service revenues to be included in subsidy determinations. An ideal methodology in this area would reflect: 1) the costs of maintaining a readiness-to-serve level of assets associated with the carrier-of-last-resort obligation; 2) selection of market determined equipment lives to reflect a fully competitive environment; 3) recognition of changes in return (cost of money) requirements; and 4) development of sufficient margins in subsidization levels to attract equal or more efficient competitive network suppliers.

E. Ability to Modify Data to Reflect Unique Situations

As no one methodology is likely to be able to address every situation, another desirable characteristic of a proxy model is the ability to be easily modified to reflect situations that were either not accounted for in the original design or have arisen after the model has been developed. It is most desirable to allow controversial methods, data and assumptions to be changed by the user of the model, without intervention from programming staff or the original developers. While such an ideal is unlikely to occur, models constructed with more flexibility are more desirable than those with less.

II. Overview Of Models Reviewed In This Submission.

A. Benchmark Cost Model - Version 1 (BCM1)²

Version 1 of the Benchmark Cost Model was jointly sponsored by USWest, NYNEX, Sprint and MCI. The purpose of the model was threefold:

First, it was to be used to identify *average* costs required to serve residential customers residing within Census Block Groups.

Second, it was intended to develop a range of benchmark costs reflecting the provision of basic residential service by means of efficient design and the use of state-of-the-art technology. It does not develop actual or embedded costs, it does not claim to model the cost of the company which is obligated to provide service to the households in a given census block group (although it does use existing switch locations); it does not include business lines in its calculations either for purposes of determining business costs or for calculating the economics of scale in serving residences. An estimation of business lines was used only in calculation of the shared costs of switching.

It's third purpose was to allow evaluation of differing proposals for targeting high cost support, primarily through the use of different benchmark revenues above which subsidies would occur. The model would calculate a total subsidy for an area, based on the difference between the benchmark cost level and the rate to be charged or revenue per line anticipated to be received by the Universal Service Provider.

Some of the important methodological aspects of the BCM1 model are:

- Geography The use of Census Block Group (CBG) was used as the geographical base unit. Each CBG is identified by number and carries the total number of resident households (generally a CBG has between 250 and 550 households but the range of households is considerably greater) as

² The overview of the Benchmark Cost Model - Version 1 was created from the slide presentation given by the Joint Sponsors on September 22, 1995 in Denver. I am unaware of any official overview that has been produced for this model.

well as the number of square miles of area in the CBG . BCM1 then assumes this area to be a square in shape around the centroid of the CBG³.

- Assignment of CBGs to Wire Centers. Wire Centers are assigned to CBG by determining the nearest wire center calculated using airline distance from the Wire Center to the centroid of the CBG. All households in the CBG are assigned to one wire center.
- Feeder Topology. Feeder cables are assumed to run straight North, South, East or West from the wire center to a line perpendicular to the center of a side of the square representation of the CBG. From this point sub-feeder is assumed to run along the perpendicular line to the edge of the (square) CBG. Total feeder distance is calculated by subtracting $\frac{1}{2}$ of the length of one side of the CBG square from the sub-feeder length first taken to the center of the square (to place the end of the feeder at the edge of the square CBG) and adding the remaining length of the subfeeder to the length of the main route feeder. Assignment of a CBG to a particular feeder route is accomplished by measuring the angle of the centroid of the CBG to the due East direction (any direction could be chosen; this one is typically chosen for measurement of radial angles) If the resultant angle is between 45° and 135° , the North route is chosen. Between 135° and 225° , the West route is chosen, etc. This process selects the route with the shortest (right angle) distance from the assigned wire center to the CBG.
- Distribution Topology. Distribution plant architecture assumes that households are evenly distributed in the reformatted (square) CBG area; that the distribution cable begins at the edge of the CBG and ends at the

³Note that this geometry which underlies BCM1, BCM2, and the Hatfield model creates square areas which overlap and which do not entirely cover the terrain even though the areas sum to the area of the terrain. It is assumed that the costs of serving the overlapping areas compensate for the costs of serving the uncovered areas.

subscribers' premises; and that four legs of distribution cable are required to serve a customer within a CBG⁴. The length of these distribution legs is calculated as ¼ of the distance of one side of the CBG square. The size of the distribution cable is calculated by dividing the number of households within the CBG by 4 and selecting the next largest size cable.

- Loop Technology. Loop technology is assumed to be analog copper cable for loop lengths that are less than 12000 feet. The technology is assumed to be one of two types of fiber with digital loop carrier for lengths greater than 12000 depending upon the density of the CBG.
- Loop Components. The model does not include investments for a Network Interface Device (NID), Drop Wire, Terminals/Splices, Serving Area Interface Cabinets, Tandem Switching, Signaling Network, Transport and Operator Systems.
- Switching Technology. Switching technology was assumed to be a DMS-100 switch for all CBGs. The cost of the switch was split between common costs and per line costs.
- Density Cells. Plant technology mixes, fill factors and placement costs are assumed to vary with density in the following 6 ranges:

0 ≤ and ≤ 5

5 < and ≤ 200

200 < and ≤ 650

650 < and ≤ 850

850 < and ≤ 2550

and > 2550

⁴ The claim of uniform distribution of households is false. In fact, households are assumed to be clustered at the ends of the four distribution legs. There is not enough linear feet of distribution plant to reach uniformly distributed premises.

- **Terrain.** Placement costs are modified by the prevalent terrain within a CBG based on terrain and water table indicators from data produced by the U.S. Geological Survey.
- **Expenses.** Expenses are calculated by deriving an expense to investment ratio from ARMIS 43-01 forms excluding, in some cases, certain overhead accounts.

B. Benchmark Cost Model - Version 2 (BCM2)⁵

Version 2 of the Benchmark Cost Model is jointly sponsored by USWest and Sprint. The purpose of this model is slightly different than the purpose of the original version. While all of the goals of Version 1 are retained, an additional goal of using the model to “Serve as a basis of critique of studies of unbundled network elements” has been added.⁶

Significant changes in methodological approach have been made to BCM2 from the methods employed in BCM1. To allow for ease of comparison, the methods will be presented here in the order that the BCM1 methods were discussed above.

- **Geography.** Use of Census Block Group (CBG) as the geographical base unit remains in BCM2. However, to account for a bias toward longer loop lengths that occurs when significant amounts of vacant land are included in a CBG, BCM2 recalculates the area associated with a CBG if its density is 20 households per square mile or less. In CBGs that meet this criterion, a buffer zone of 500 feet on each side of the road system (or 100 square feet per linear foot of road) is constructed to substitute for the measured area of the CBG.

⁵ The overview of the Benchmark Cost Model - Version 2 has been excerpted, paraphrased and derived from the methodology document provided at the sponsors July 18-23, 1996 Workshop. Where exact quotes are important to clarity they will be enclosed in quotation marks. In all other cases, liberties will be taken with sentence structure and form to enable consistent presentation.

⁶ This information did not come from the document referenced in the previous footnote but rather comes from the presentation offered at the July 18-23, 1996 Workshop.

- **Assignment of Wire Centers to CBGs.** As in BCM 1, Assignment of CBGs to Wire Centers is accomplished by determining the nearest Wire Center on the basis of airline distance from the Wire Center to the centroid of the CBG.
- **Feeder Topology.** Feeder cables are assumed to be oriented as in the BCM1. From the main feeder, sub-feeder is assumed to run to the edge of the CBG (as in BCM1), unless the length of feeder would violate a maximum copper distribution limitation. Unlike BCM1, if the maximum limit of copper is exceeded, the feeder is continued into the CBG for the amount that the distance exceeds the limit. Feeder distance is calculated by subtracting $\frac{1}{2}$ of the length of one side of the CBG square, or the maximum copper distribution limit, from the sub-feeder and adding the remaining airline distance to the airline distance of the main route feeder. Assignment of a CBG to a particular feeder route is accomplished in the same manner as BCM1.
- **Distribution Topology.** Distribution plant architecture assumes that households are evenly distributed along roadways (i.e., within the CBG area now limited to the 1000 ft. wide road swath). The distribution cable begins at the end of the feeder and ends at the subscribers' premises. Multiple legs of distribution cable are required to serve a customer within a CBG. The length of these distribution legs is based directly on the length of a side of the CBG which is modified by reference to two slope values which are input by the user. Each slope value has an associated slope modification factor that increases the length of the CBG side. The length of the distribution legs is then calculated by assuming a uniform lot size which apportions the modified CBG area to households, and calculates the number of distribution legs and length required to serve all

lots within the CBG square (or road swath). The size of the distribution cable is calculated by dividing the estimated number of lines served within the CBG (after adjustment for business lines) by the number of vertical or horizontal distribution legs in the CBG and selecting the next largest size cable.

- **Loop Technology.** Loop technology is assumed to be analog copper cable for loop lengths that are less than user selectable values of 9,000, 12,000, 15,000 or 18,000 feet. For length greater than the breakover length, one of two types of fiber based digital loop carrier is assumed dependent upon the density of the CBG. Additionally, loop investment is capped at \$10,000 under the assumption that more costly loops will be served by an alternative wireless loop technology costing \$10,000 per home served.
- **Loop Components.** BCM2 includes investments for a Network Interface Device (NID), Drop Wire, Terminals/Splices, Serving Area Interface Cabinets, Tandem Switching, Signaling Network, Transport and Operator Systems.
- **Switching Technology.** Switching technology is assumed to be an average value for each of five switch sizes. The cost of the switch is split between start-up costs and per line costs.
- **Density Cells.** Plant technology mixes, fill factors and placement costs are assumed to vary with density in the following 6 ranges:

$0 \leq \text{and} \leq 5$

$5 < \text{and} \leq 200$

$200 < \text{and} \leq 650$

$650 < \text{and} \leq 850$

$850 < \text{and} \leq 2550$

$\text{and} > 2550$

- Terrain. Placement costs are modified by the prevalent terrain within a CBG, based on terrain and water table indicators from data produced by the U.S. Geological Survey as in BCM1.
- Expenses. In BCM2, three investment related annual cost factors are created from 1995 ARMIS data. These factors are for Cable, Switching and Circuit equipment investments. Additionally, a non-plant related expense factor is calculated by taking the ARMIS categories of Customer Operations - Marketing, Customer Operations - Services, Corporate Operations and Other Depreciation/Amortization and developing a per line expense amount, based on total access lines. The capability to scale this amount is also provided.

C. Hatfield Model - Version 2.2 (HM)⁷

The Hatfield Model was prepared by Hatfield Associates Inc. for AT&T Corporation and MCI Telecommunications Corporation. The goal of the Hatfield Model is "... to model the economic costs of all narrowband local telephone services provided to business and residence customers, including access services provided to interexchange carriers ("IXCs")." Key aspects of the Hatfield Model are:

- Geography. Use of Census Block Group (CBG) as the geographical base unit is also a feature of the Hatfield Model. The Hatfield Model obtains its geography from the BCM1, its treatment is the same as described there.
- Assignment of CBGs to Wire Centers. The assignment of CBGs to wire centers is adopted from BCM1.

⁷ The overview of the Hatfield Model - Version 2.2 has been excerpted, paraphrased and derived from the document entitled *Documentation of the HATFIELD MODEL - Version 2.2 - release 1* dated May 16, 1996. Where exact quotes are important to clarity they will be enclosed in quotation marks. In all other cases, liberties will be taken with sentence structure and form to enable consistent presentation.

- Feeder Topology. Feeder cable lengths and assignments to routes are also performed by the BCM1 algorithms as described above.
- Distribution Topology. Distribution plant architecture is also provided by BCM1.
- Loop Technology. Loop technology is assumed to be analog copper cable for loop lengths that are less than 12000 feet. For lengths longer than 12000 feet the technology is assumed to be one of two types of fiber with digital loop carrier for lengths greater than 12000 dependent upon the density of the CBG. This information is also adopted from BCM1.
- Loop Components. The Loop includes investments for a Network Interface Device (NID), Drop Wire, Terminals/Splices, Serving Area Interface Cabinets, Tandem Switching, Signaling Network, Transport and Operator Systems. The Hatfield model added these items missing from BCM1. The costs of these items are different than those included in BCM2.
- Switching Technology. Switching technology in the Hatfield Model is determined by the total number of lines served in each wire center, with a maximum line size of 80,000 for any given wire center. Switching investments are calculated by using switch investment per line, two linear relationships between total investment switch per line and line size of the central office; one straight line for relationships in larger offices and another for smaller offices.
- Density Cells. Plant technology mixes, fill factors and placement costs are assumed to vary with density in the following 6 ranges obtained from BCM1.

- **Terrain.** Placement costs are modified by the prevalent terrain using the methods and values of BCM1.
- **Expenses.** Network related expenses are calculated as investment based factors for five categories in the HM. They are: Network Support, Switching, Transmission, Cable and Network Operations. Additionally, non-network related expenses are assigned on the basis of 10% of total expenses and a factor for General Support Equipment is applied to total investment to account for such items as furniture, office equipment and general purpose computers.

D. Cost Proxy Model (CPM)

The Cost Proxy Model (CPM) was jointly developed by Pacific Bell and INDETEC International. The purpose of the model was to use sound financial, engineering, economic, and managerial accounting principles to provide the costs, revenues, and resulting subsidy requirement of providing Universal Services.

The essence of the concept and methodology of the Cost Proxy Model (CPM) is to aggregate the diverse costs of serving customers in different locations under different circumstances using economic and engineering efficiency principles. This is accomplished through the use of readily available data, calculations, and algorithms to approximate the actual costs of providing service using current and forward-looking engineering practices.

Some of the more important methodological approaches that the CPM incorporates include:

The CPM uses a "bottoms-up" approach to cost starting with the cost of small components of the network and universal services, and aggregating those components to simulate cost of universal service. All costs are expressed in appropriate metrics such as the cost per foot of aerial copper cable, cost per

switched minute of use, or cost per bill rendered. These metrics can be assembled into unbundled components and services which matches the way the network can be engineered using presently available technologies. Customer and geographic data requirements can be met through company proprietary data (e.g. actual household locations) or via a number of commercially available governmental and private data providers.

Some Key Characteristics of the CPM are:

- **Assignment of Households to Wire Centers and Geography.** The CPM starts with a small, uniform geography, termed a "grid". A grid is 1/100 of a degree of latitude by 1/100 of a degree of longitude (or ≈ 3000 ft. by ≈ 3000 ft.). This grid size is an appropriate size to reflect the dispersion or clustering of premises and multiple grids can be combined to capture density information that is needed to select engineering criteria for network design. The grid geography is uniform across the nation and divides the terrain into mutually exclusive and exhaustion areas. The use of this grid along with the use of actual Wire Center boundaries approximated by collections of Grids allows the assignment of households in a Grid to the serving wire center within which the households fall.
- **Feeder Topography.** Feeder length calculations are based on the air distance from the centroid of each grid to the wire center which serves the grid. Air distance is then converted into Feeder lengths based upon statistically derived ratios of feeder to distribution length ratios developed from sample records, engineering records, or national standard values. Finally, air distances are converted into route distances, again based upon statistically derived air to route length ratios. Cable sizes are selected based on the total demand for

loops using daytime population to estimate the number of business lines in each grid cell.

- **Distribution Topology.** Distribution lengths are calculated in the same manner as feeder lengths using air distances from the end of the average feeder length (for premises at a specified distance from the wire center in each density zone) to the premises. As with feeder cable, sizes are selected to meet total demand.⁸
- **Loop Technology.** The CPM presently uses a 9000 foot *feeder*⁹ length as the fiber breakover point. Shorter feeder length are assumed to be copper and longer length are assumed to be fiber¹⁰. The CPM employs an A + Bx approach. The A costs are those driven by number of routes in which cables reside. The B costs are those which vary by the number of pairs in a cable or cable route. In addition to the use of the A + Bx approach, the CPM also separately develops the costs for Poles and Conduit.

Once the costs are developed, they are unitized to a per pair cost that incorporates the number of cables, the cable size, the terrain characteristics, etc.

- **Loop Components.** Loop components include investments for a Network Interface Device (NID), Drop Wire, Terminals/Splices, Serving Area Interface

⁸ The CPM also uses Daytime Population data at the grid level to estimate numbers and locations of business lines. By using this data, the CPM is able to more accurately determine the density of the area, thereby allowing correct sizing of distribution cable that would be needed to satisfy the total demand in an area or to satisfy the increment of demand defined as the Universal Service obligation. Thus residential customer costs realize the benefits of economics of scale from sizing cable in both feeder and distribution plant to meet total demand.

⁹ This choice thus employs fiber when the *total* loop length is larger than 9000 feet by the amount of distributable length. This breakover point can be modified (and has been modified as requested in specific situations) but is now a user input.

¹⁰ Feeder length rather than total loop length appears to be the most common engineering determinant of the breakover point.

Cabinets, Tandem Switching, Signaling Network, Transport and Operator Systems.

- **Switch Technology.** Switching costs are input in three categories; costs per message, per minute of use, and per line (any of these may have a zero value if, for example, it is desirable to have costs reflected on a per line basis). The default values are presently from an average of SCIS outputs for a mix of Northern Telecom and AT&T switches.
- **Density Cells.** The CPM uses three density measures: the households (and lines) per square mile for 1) each grid cell, 2) a cluster of nine grid cells (3 grids x 3 grids) around each grid cell, and the exchange area of each wire center. The density cells on which costs vary are

0 - 10
11-50
51-150
151-500
501-2000
2001-5000
5000+

- **Terrain.** The CPM uses terrain data exactly as is used in BCM2 model with the exception of the slope data. The numerical values representing the difficulty of placement for each terrain characteristics is a user input and may differ from the value in the BCM2.
- **Expenses.** Operating expenses are determined by examining the cost drivers for each expense category, expenses associated with universal services were included when the universal service functions would cause such costs. Each expense can be included, or modified by the user. To account for the size efficiency attendant to large LECs, the CPM incorporates the use of an ARMIS derived ratio. This ratio is based upon the relative operating expenses

of the company compare to an average (statewide/nationwide), so that large companies are not benefited and small companies are not penalized. Although the ARMIS value is used to estimate relative efficiencies among different sized companies, ARMIS is not used to determine the base levels of expenses. Such expense levels would be forward-looking and based on economic principles, rather than historical accounting, practices.

III. Methodological Comparisons Of The Models On The Key Characteristics

A. Development of Base Geographic Information

BCM1, BCM2 and the Hatfield Model all use (square) Census Block Groups (CBG) as their basic unit of geography. The CPM, however, utilizes a "grid" which is 1/100 of a degree of latitude by 1/100 of a degree of longitude, or approximately 3000 feet by 3000 feet.

CBGs are developed to be a manageable group of households for census takers to handle in the performance of their duties and to protect the privacy of individuals in reporting census information. As such, the key determinant of what constitutes a CBG is the number of households within it instead of a geographic area related to engineering decisions. Within the state of California, the range of areas is from less than 1000 square feet to over 4,300 square miles. BCM1, BCM2, and the Hatfield model assume the distribution areas coincide with CBGs defined and assign each CBG to one wire center (that closest to the centroid of the CBG) even when multiple wire centers or multiple companies may serve the households in that CBG.

The use of uniform grid level data minimizes these effects. Where the CBG approach has the characteristics of relying on predefined data obtained by the U. S. Census Bureau, use of the grid system can accommodate Census data exactly as the

BCM1, BCM2, and Hatfield Model but can also accommodate input from actual geocoded customer data or from household and business data assigned to grid cells.

Clearly, the finer the level of geographic resolution, the more accurate the results will be.

B. Determination of Technology and Facility Mixes

There are several aspects to the determination of technology selection and facility mixes to be considered. First, is the determination of the cutover point in the placement of fiber-fed electronics instead of copper. BCM1 and the Hatfield Model both offer only one choice in this area and that is set at 12,000 feet of *total* loop length. BCM2 allows choices of 9,000, 12,000, 15,000 and 18,000 feet of total loop length in a user selectable fashion. The CPM uses a single cutover point at 9,000 feet of *feeder* length as its determining point (thus, a longer total loop length). This is a slightly different approach than the other models, based on the determination that it appears to be the feeder length that drives the engineering decision instead of the total loop length.

C. Methodology Used in Assigning Geographic Units to Wire Centers

BCM1, BCM2 and the Hatfield Model all assign a CBG to the nearest wire center based on airline distance to the centroid. The CPM assigns grids to wire centers based on digitally encoded wire center boundaries.

Use of the nearest wire center to the centroid of a CBG can result in significant misassignment of households to serving wire centers and even to serving companies. For example, there is a CBG in Baker, California that contains 1,414 square miles. If this CBG were a perfect circle, the centroid of the CBG could be no closer to the edge than 21 *miles*. This particular CBG had 221 households within it. If one assumes, as would generally be true, that these households are *not* equally distributed over the entire area, then there would, of necessity, be clusters of households within the CBG. With these types of distances involved, it is unlikely that the wire center nearest the centroid is the one nearest the population center. Additionally, there may be physical

limitations, such as mountains or large lakes, that prohibit the provision of service from the nearest wire center.

The preferred method of association is to identify households at a sufficiently detailed level to be able to utilize actual data on the wire center serving that particular area.

D. Assumptions Behind the Development of Financial Data

BCM1 used a single annual cost factor to convert investment into expense. BCM2 creates three annual cost factors to reflect different lives and costs for different types of equipment. The Hatfield Model appears to create capital cost factors for a number of different categories of plant. The CPM also relies on multiple capital cost factors and separate expense elements for its calculations.

Capital cost factors and separate expense factors or direct assignments are the preferable methodology for use in calculating subsidy costs because of the greater level of detail available. However, careful examination of the values assigned to these factors is warranted due to the large influence they have on the resultant cost. Costs can be artificially lowered by selection of longer depreciation lives than are warranted by a competitive environment or by the selection values for the cost of debt and equity that are too low for the monetary marketplace. The reverse is also true if unreasonably short lives are chosen or too high a cost of funds is applied.

E. Ability to Modify Data to Reflect Unique Situations

While this characteristic does not directly impact the levels of cost produced by a proxy model, it is a necessary functionality of a quality model. Artificial limitations or restrictions on the type of data and the manner of its calculation do not serve the end result well. An example would be where a company, through aggressive negotiations, has obtained a significantly greater discount on electronic equipment required to provide digital subscriber line carrier over fiber optic cable. As this cost is the primary driver of the economic breakover point between copper and fiber, this hypothetical company

would have a breakover point that is significantly shorter than its competitors. This feature should be able to be reflected in any proxy model used for universal service subsidies, after proper consideration of its impact on other engineering practices.

In general, the fewer hard coded restrictions that exist in a system, the better that system can adapt to unforeseen situations.

IV. The Incumbent Companies Costs Should Be Used For Subsidy Determination Rather Than Using The Costs Of An Hypothetical Efficient Entrant

A. Unrealistic Subsidy Levels will Hinder Competition.

First, to the extent that any inefficiencies exist within the LEC's today, they will make LECs more vulnerable to competitors only if their prices reflect such inefficiencies. In unregulated markets, prices reflecting less efficient production is the very engine which fuels the competitive process. It is only through price signals that firms which are equally or more efficient than existing providers will have an incentive to actually enter and be more efficient. It is only through the competitive process that the market determines which providers (each considering their own opportunity costs of their own resources) should and will offer service.

Second, subsidies based on the configuration of the most efficient provider, in a theoretical sense, do not comport with actual markets and market behavior. In real markets, firms do not have homogeneous cost and production functions. In the competitive process it is the costs of the *least efficient* provider (which actually survives in the market) which reflects the price in the market. Other, more efficient providers, through superior resources, better planning or luck, reap returns to their superiority.

Finally, every firm faces the prospect of incurring sunk costs upon entry. Just as firms trade off fixed for variable costs to minimize risk and costs, so too do firms trade

off sunk expenditures for liquid expenditures. To create rules which disregard sunk costs would not only distort the selection of productive assets by firms but would fundamentally alter the very incentives to enter and exit which competition so efficiently provides. This argues for using the incumbent provider's achievable costs in setting prices. Achievable costs reflect the state of the existing asset base of an incumbent, allowing new entrants to advantage themselves using newer technology. Once entered, however, the entrant makes the most economical *changes* to its assets through time. It too then competes based on its *achievable costs* including their prospective or prior irrevocable commitments. This results in a heterogeneous industry. This heterogeneous set of costs makes up the industry cost function and, as the traditional textbooks tell, it is the marginal firms which enter and exit the industry based on their respective unique efficiencies as market prices change. To assume every firm has the homogeneous cost structure of a theoretical entrant strips the competitive process and its surrogates of some of its important dynamic characteristics.

V. Additional Concerns Expressed by Other Respondents

It is my understanding that other parties interested in the outcome of this proceeding have provided the Commission staff with their "analysis" of what is wrong with the Cost Proxy Model. Via this vehicle, I will respond to those criticisms.

A. The Cost Proxy Model uses data specific to Pacific Bell.

This statement is not completely true. While it is true that Pacific Bell engineers had a major input to the definition of activities and collection of data, since the CPM was jointly developed by INDETEC International and Pacific Bell, additional engineering expertise was brought to bear through INDETEC International's internal resources. All decisions concerning the engineering guidelines and practices were filtered through engineers with broader experience than Pacific Bell alone. Additionally, it has been INDETEC's experience that, while there are always local variations to be accounted for,

good engineering remains good engineering regardless of the area in which it is applied. One of the benefits of using Pacific Bell territory as a base case is that it contains many varied geographic, topological and climatological areas within its service territory that are not combined in the service areas of many other companies. None of the models evaluated here are without engineering assumptions and quantitative values derived from some comparable source.

B. CPM reflects an overbuilt POTS system.

The other respondents in this case appear to have the erroneous impression that costs or facilities for Pacific Bell's broadband network were somehow included in the Cost Proxy Model determinations. Pacific Bell has chosen to implement their broadband network as an overlay on the existing network and none of those costs were considered for inclusion in the Cost Proxy Model. If there were any impact at all from the creation of this network, it would likely be to downsize the existing network and increase fill factors due to the anticipated availability of broadband facilities. Again, good engineering practices do not recommend placing facilities that will rapidly be useless and with the capital budget limitations faced by all telephone companies today, dollars can be more productively spent than to waste them on overbuilding.

C. CPM uses overpriced facilities and expense costs.

The response in this area seems to argue that use of recent historical data as an estimator of the cost of future activity is inherently flawed and offer the argument that no accommodation was made for future productivity gains. I would submit that recent history is a relatively accurate predictor of future costs due to the recent decline in equipment prices and effects of downsizing on the cost of activities. Additionally, it must be recognized that certain costs will increase in the future, thereby offsetting some of any productivity gains made by company. In the absence of any specific changes expected to occur in provisioning practices, it is no better to pick an arbitrary productivity gain

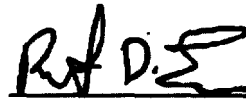
number and, in fact, may be more harmful by removing profit incentives, than it is to rely on historical cost levels that are appropriately examined.

D. The wrong technology is chosen for loop electronics.

It has been suggested that the CPM is wrong for not including Next Generation Digital Loop Carrier (NGDLC) in its loop modeling. NGDLC is the *next generation* of loop facilities that will be considered for provision of service. It has not, however, reached the stage where it is in widespread use, nor has it gone through the initial downturn in price that occurs with all new technology implementations. Additionally, the CPM has included the next generation of loop facilities to the extent that these technologies are most efficient today.

VII. Declaration

I declare under penalty of perjury that the foregoing is true and correct. Executed on August 9, 1996 at Del Mar, California.


Richard D. Emmerson